REMARKS

This amendment is responsive to the Office Action dated November 16, 2007. Applicant has amended claims 1, 3, 5, 13, 15, 19, 21, 23, 24, 27, 29, 31, 32 and 33. Applicant has cancelled claims 2, 4, 20, 22 and 28. Claims 1, 3, 5-19, 21, 23-27 and 29-33 are pending.

Allowable Subject Matter

In the Office Action, the Examiner objected to claims 10-12, 17-18 and 25 as including subject matter that would be allowable if rewritten in independent form. The Examiner also objected to claim 13 as being dependent upon a rejected base claim, but would be allowable if the objections to claim 13 are overcome, and if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicant thanks the Examiner for this indication of allowance.

Claim Rejection Under 35 U.S.C. § 103

As a preliminary matter, Applicant notes that the Examiner relied on a reference authored by LeMartret as prior art under 35 U.S.C. 103 without properly citing the reference in the Notice of References Cited (PTO-892) attached to the Final Office Action. The Examiner also failed to provide Applicant was a copy of the reference. In response to a telephone conversation with Applicant's representative, the Examiner acknowledged this oversight and provided an electronic copy of the LeMartret reference. Applicant has cited the LeMartret reference in an Information Disclosure Statement included herewith.

In the Office Action, the Examiner rejected claims 1-9, 14-16, 19-24 and 26-33 under 35 U.S.C. 103(a) as being unpatentable over LeMartret ("All-Digital Impulse Radio for MUI/ISI-Resilient Transmissions through Frequency-Selective Multipath Channels") in view of Zhou ("Chip-Interleaved Block-Spread Code Division Multiple Access"). Applicant respectfully traverses the rejection. The applied references fail to disclose or suggest the inventions defined by Applicant's claims, and provide no teaching that would have suggested the desirability of modification to arrive at the claimed invention.

Claims 1, 3, 5-18 & 33

Applicant amended independent claims 1 and 33 to include all the subject matter of dependent claims 2 and 4, now cancelled, to more clearly claim the multi-stage block-spreading techniques for generating an ultra wideband (UWB) transmission signal. Applicant's claims 1 and 33 now recite generating a stream of frames from blocks of information bearing symbols by applying an orthogonal set of spreading codes to the blocks of symbols to form the frames and interleaving the frames corresponding to different blocks of symbols to form the stream of frames, generating a stream of chips from the stream of frames by applying an orthogonal set of time-hopping spreading codes to the interleaved frames to form the chips and interleaving the chips corresponding to different frames to form the stream of chips, and outputting an UWB transmission signal from the stream of chips.

The Examiner stated that LeMartret discloses generating a stream of frames from blocks of information bearing symbols where the frames are interleaved because section 2.1 of the LeMartret reference describes multiuser spreading that is equivalent to symbol-spreading followed by frame interleaving. The Examiner appears to have misinterpreted the LeMartret reference. In general, the LeMartret reference discloses a continuous Multiple Input Multiple Output pulse-position modulation (PPM)-impulse radio multiple access (IRMA) scheme and proposes digital receivers for the downlink. In section 2.1, relied upon by the Examiner, LeMartret merely reviews the conventional PPM-IRMA model in the single-user case. LeMartret discloses a block-periodic code that implies a block spreading operation where each block of K information bearing symbols is spread by the same hopping sequence over KN_f frames. In other words, LeMartret discloses a time-hopping spreading code applied to blocks of symbols to form chips.

LeMartret does not describe generating a stream of frames from blocks of information bearing symbols by applying an orthogonal set of spreading codes to the blocks of symbols to form the frames and interleaving the frames corresponding to different blocks of symbols to form the stream of frames, as required by Applicant's claims 1 and 33. Contrary to the Examiner's assertions, LeMartret fails to make any mention of generating a stream of frames where the frames corresponding to different blocks of symbols are interleaved. Further, LeMartret fails to

disclose forming frames by applying spreading codes to the blocks of symbols and interleaving the frames. Instead, LeMartret teaches generating a set of chips by applying time-hopping spreading codes to blocks of symbols.

The Examiner acknowledged that LeMartret does not disclose generating a stream of chips from the stream of frames where the chips are interleaved, but stated that the Zhou reference discloses such features. The Examiner further stated that it would have been obvious to a person of ordinary skill in the art to incorporate in the multiuser technique disclosed by LeMartret the chip interleaving disclosed by Zhou to reduce the multiuser interference with low-complexity. The Examiner appears to have also misinterpreted the Zhou reference. In general, the Zhou reference discloses a multiuser-interference (MUI)-free code division multiple access (CDMA) transceiver based on a specific block-spreading operation implemented by symbol-spreading followed by chip interleaving. In section II, the Zhou reference describes the system model and discloses user-specific spreading codes applied to blocks of symbols to form chips and then interleaving the chips.

Zhou does not describe generating a stream of chips from the stream of frames by applying an orthogonal set of time-hopping spreading codes to the interleaved frames to form the chips and interleaving the chips corresponding to different frames to form the stream of chips, as required by Applicant's claims 1 and 33. Contrary to the Examiner's assertions, Zhou fails to make any mention of generating a stream of chips from a stream of frames. Furthermore, Zhou fails to disclose forming chips by applying time-hopping spreading codes to the stream of frames and interleaving the chips. Instead, Zhou teaches generating a set of chips by applying user-specific spreading codes to blocks of symbols and interleaving the chips.

Moreover, a person of ordinary skill in the art would find no rational reason to modify the LeMartret reference, which teaches generating a set of chips by applying time-hopping spreading codes to blocks of symbols, with the Zhou reference, which teaches generating a set of chips by applying user-specific spreading codes to blocks of symbols and interleaving the chips. As described above, both LeMartret and Zhou teach generating a set of chips by applying different types of spreading codes to blocks of symbols such that combining the references would merely result in two separate methods of generating a set of chips from blocks of symbols. The combined references fail to teach Applicant's invention as claimed. For example, neither

LeMartret nor Zhou make any mention of forming frames by applying spreading codes to blocks of symbols or interleaving the frames to generate a stream of frames. In addition, neither of the cited references contemplates forming chips by applying time-hopping spreading codes to interleaved frames and interleaving the chips to generate a stream of chips.

LeMartret and Zhou, either separately or in combination, fail to teach each and every element of Applicant's independent claims 1 and 33. The cited references also fail to teach the features of Applicant's claims 3 and 5-18 dependent upon claim 1. For example, Applicant's dependent claim 8 recites that the set of spreading codes and the set of time-hopping spreading codes are mutually orthogonal so that the interleaved and padded chips retain their orthogonality after passing through a multi-path communication channel. As the Examiner correctly states, Zhou discloses that chip-interleaving and zero padding at the transmitter preserves mutual orthogonality between different users' codes even after multipath propagation. However, neither Zhou nor LeMartret discloses mutual orthogonality between user-specific spreading codes and time-hopping spreading codes.

As another example, Applicant's dependent claim 9 recites assigning each of the set of spreading codes to a different user of a group of users, and assigning each user of the group a common one of the set of time-hopping spreading codes. Although the Zhou reference describes user-specific spreading codes and the LeMartret reference describes time-hopping spreading codes, the cited references both fail to teach assigning a user in a group of users a user-specific spreading code and a group-common time-hopping spreading code.

Furthermore, Applicant's dependent claim 14 recites receiving the signal, and outputting a stream of estimate symbols from the signal using a two-stage de-spreading unit having a time-hopping de-spreading module and a multi-user de-spreading module. Applicant's dependent claim 15 recites converting the signal to a stream of chips, applying a first de-spreading matrix with the time-hopping de-spreading module to de-interleave the chips into blocks of frames, applying a second de-spreading matrix to the blocks of frames with the multi-user de-spreading module to de-interleave the frames and produce blocks of estimate symbols, and applying a single user detection scheme to the blocks of estimate symbols to output the stream of the estimate symbols.

The LeMartret reference discloses recovering symbols by converting the received signal into chips and applying a time-hopping de-spreading code matrix to the chips. The Zhou reference discloses recovering symbols by converting the received signal into chips and applying a user-specific de-spreading code matrix to the chips. However, neither reference describes recovering a stream of symbols from the received signal using a two-stage de-spreading unit having both a time-hopping de-spreading module and a multi-user de-spreading module.

As described above, a person of ordinary skill in the art would find no rational reason to modify the LeMartret reference with the Zhou reference. Both LeMartret and Zhou teach recovering blocks of symbols by converting a received signal into a set of chips and applying a different de-spreading code matrix to the chips such that combining the references would merely result in two separate methods of recovering blocks of symbols from a set of chips. Neither LeMartret nor Zhou makes any mention of de-interleaving the chips into blocks of frames and then de-interleaving the frames into blocks of symbols. In addition, neither of the cited references contemplates de-interleaving the chips into blocks of frames by applying a time-hopping de-spreading matrix and de-interleaving the frames into blocks of symbols by applying a multi-user de-spreading matrix to de-interleave the frames.

Claims 19, 21 & 23-26

Applicant amended independent claim 19 to include all the subject matter of dependent claims 20 and 22, now cancelled, to more clearly claim the multi-stage block-spreading techniques included in the wireless communication device. Applicant's claim 19 now recites a multiple-user block-spreading unit that generates a set of frames for respective blocks of information bearing symbols by applying an orthogonal set of spreading codes to the blocks of symbols and produces a stream of frames in which the frames from different sets are interleaved, a time-hopping block-spreading unit that generates a set of chips for each frame by applying an orthogonal set of time-hopping spreading codes to the interleaved frames and outputs a stream of chips in which the chips generated from different frames are interleaved, and a pulse shaping unit to output an UWB transmission signal from the stream of interleaved chips.

The Examiner stated that LeMartret discloses a multiple-user block-spreading unit that produces a stream of frames from blocks of symbols and a time-hopping block-spreading unit

that outputs a stream of chips from the frames. The Examiner acknowledged that LeMartret does not disclose that the chips generated from different frames are interleaved, but stated that the Zhou reference discloses such features. The Examiner further stated that it would have been obvious to a person of ordinary skill in the art to incorporate in the multiuser technique disclosed by LeMartret the chip interleaving disclosed by Zhou to reduce the multiuser interference with low-complexity.

As described above in reference to Applicant's independent claims 1 and 33, LeMartret fails to make any mention of generating a stream of frames where the frames corresponding to different blocks of symbols are interleaved. Further, LeMartret fails to disclose forming frames by applying spreading codes to the blocks of symbols and interleaving the frames. Instead, LeMartret teaches generating a set of chips by applying time-hopping spreading codes to blocks of symbols. In addition, Zhou fails to make any mention of generating a stream of chips from a stream of frames. Furthermore, Zhou fails to disclose forming chips by applying time-hopping spreading codes to the stream of frames and interleaving the chips. Instead, Zhou teaches generating a set of chips by applying user-specific spreading codes to blocks of symbols and interleaving the chips.

Moreover, a person of ordinary skill in the art would find no rational reason to modify the LeMartret reference with the Zhou reference. As described above, both LeMartret and Zhou teach generating a set of chips by applying different types of spreading codes to blocks of symbols such that combining the references would merely result in two separate methods of generating a set of chips from blocks of symbols. The combined references fail to teach Applicant's invention as claimed. For example, neither LeMartret nor Zhou make any mention of forming frames by applying spreading codes to blocks of symbols or interleaving the frames to generate a stream of frames. In addition, neither of the cited references contemplates forming chips by applying time-hopping spreading codes to interleaved frames and interleaving the chips to generate a stream of chips.

LeMartret and Zhou, either separately or in combination, fail to teach each and every element of Applicant's independent claim 19. The cited references also fail to teach the features of Applicant's claims 22 and 24-26 dependent upon claim 19. For example, Applicant's claim 24 recites that the set of spreading codes and the set of time-hopping spreading codes are

mutually orthogonal so that the interleaved and padded chips retain their orthogonality after passing through a multi-path communication channel. As the Examiner correctly states, Zhou discloses that chip-interleaving and zero padding at the transmitter preserves mutual orthogonality between different users' codes even after multipath propagation. However, neither Zhou nor LeMartret discloses mutual orthogonality between user-specific spreading codes and time-hopping spreading codes.

Claims 27 & 29

Applicant amended independent claim 27 to include all the subject matter of dependent claim 28, now cancelled, to more clearly claim the multi-stage block-spreading techniques included in the wireless communication device. Applicant's claim 27 now recites a wireless communication device comprising a two-stage de-spreading unit that processes a received UWB transmission signal to produce estimate symbols, wherein the received UWB signal comprises a multi-user block-spread UWB signal formed from interleaved symbol frames and interleaved chips within the symbol frames, and wherein the two-stage de-spreading unit comprises a time-hopping de-spreading module that applies a first de-spreading matrix to de-interleave the chips into blocks of frames, and a multi-user de-spreading module that applies a second de-spreading matrix to de-interleave the frames and produce blocks of estimate symbols.

The Examiner stated that LeMartret discloses a two-stage de-spreading unit that processes a received signal formed from interleaved symbol frames to produce estimate symbols. The Examiner acknowledged that LeMartret does not disclose that the chips generated from different frames are interleaved, but stated that the Zhou reference discloses such features. The Examiner further stated that it would have been obvious to a person of ordinary skill in the art to incorporate in the multiuser technique disclosed by LeMartret the chip interleaving disclosed by Zhou to reduce the multiuser interference with low-complexity.

The LeMartret reference discloses recovering symbols by converting the received signal into chips and applying a time-hopping de-spreading code matrix to the chips. The Zhou reference discloses recovering symbols by converting the received signal into chips and applying a user-specific de-spreading code matrix to the chips. However, neither reference describes

recovering a stream of symbols from the received signal using a two-stage de-spreading unit having both a time-hopping de-spreading module and a multi-user de-spreading module.

As described above in reference to Applicant's independent claims 1 and 33, a person of ordinary skill in the art would find no rational reason to modify the LeMartret reference with the Zhou reference. Both LeMartret and Zhou teach recovering blocks of symbols by converting a received signal into a set of chips and applying a different de-spreading code matrix to the chips such that combining the references would merely result in two separate methods of recovering blocks of symbols from a set of chips. Neither LeMartret nor Zhou makes any mention of de-interleaving the chips into blocks of frames and then de-interleaving the frames into blocks of symbols. In addition, neither of the cited references contemplates de-interleaving the chips into blocks of frames by applying a time-hopping de-spreading matrix and de-interleaving the frames into blocks of symbols by applying a multi-user de-spreading matrix to de-interleave the frames.

LeMartret and Zhou, either separately or in combination, fail to teach each and every element of Applicant's independent claim 27 and dependent claim 29.

Claims 30-32

Applicant's independent claim 30 recites a system comprising a wireless transmitter to transmit an UWB signal according to interleaved chips generated from interleaved frames produced by blocks of information bearing symbols, and a wireless receiver to receive the UWB signal and de-interleave the chips and frames to produce estimate symbols.

The Examiner stated that LeMartret discloses a wireless transmitter to transmit a signal according to interleaved frames produced by blocks of symbols, and a wireless receiver to receive the signal and de-interleave frames to produce symbols. The Examiner acknowledged that the LeMartret does not disclose that the chips are interleaved and de-interleaved, but stated that the Zhou reference discloses such features. The Examiner further stated that it would have been obvious to a person of ordinary skill in the art to incorporate in the multiuser technique disclosed by LeMartret the chip interleaving disclosed by Zhou to reduce the multiuser interference with low-complexity

As described above in reference to Applicant's claims 1 and 33, LeMartret fails to make any mention of generating a stream of frames where the frames corresponding to different blocks

of symbols are interleaved. Further, LeMartret fails to disclose transmitting a signal according to interleaved frames produced by blocks of symbols. Instead, LeMartret teaches transmitting a signal according to a set of chips produced by blocks of symbols. In addition, the LeMartret reference discloses recovering symbols by converting the received signal into chips. However, LeMartret does not describe producing symbols from a received signal by de-interleaving frames.

The Zhou reference fails to make any mention of generating a stream of chips from a stream of frames. Furthermore, Zhou fails to disclose transmitting a signal according to interleaved chips generated from interleaved frames produced by blocks of symbols. Instead, Zhou teaches transmitting a signal according to interleaved chips produced by blocks of symbols. In addition, the Zhou reference discloses recovering symbols by converting the received signal into chips. However, Zhou does not describe producing symbols from a received signal by de-interleaving chips and frames.

Moreover, a person of ordinary skill in the art would find no rational reason to modify the LeMartret reference with the Zhou reference. Both LeMartret and Zhou teach transmitting a signal according to a set of chips produced by blocks of symbols and recovering symbols by converting the received signal into chips. The combined references fail to teach Applicant's invention as claimed. For example, neither LeMartret nor Zhou make any mention of transmitting a signal according to interleaved chips generated from interleaved frames produced by blocks of symbols. In addition, neither of the cited references contemplates receiving a signal and de-interleaving chips and frames to produce the blocks of symbols.

LeMartret and Zhou, either separately or in combination, fail to teach each and every element of Applicant's independent claim 30. The cited references also fail to teach the features of Applicant's claims 31 and 32 dependent upon claim 30. For example, Applicant's claim 31, as amended, recites that the transmitter comprises a multiple-user block-spreading unit that generates a set of the frames for the respective blocks of information bearing symbols by applying an orthogonal set of spreading codes to the blocks of symbols and produces a stream of frames in which the frames from different sets are interleaved, a time-hopping block-spreading unit that generates a set of the chips for each of the frames by applying an orthogonal set of time-hopping spreading codes to the interleaved frames and outputs a stream of chips in which the

chips generated from different frames are interleaved, and a pulse shaping unit to output the UWB transmission signal from the stream of interleaved chips.

LeMartret fails to make any mention of generating a stream of frames where the frames corresponding to different blocks of symbols are interleaved. Further, LeMartret fails to disclose forming frames by applying spreading codes to the blocks of symbols and interleaving the frames. In addition, Zhou fails to make any mention of generating a stream of chips from a stream of frames. Zhou also fails to disclose forming chips by applying time-hopping spreading codes to the stream of frames and interleaving the chips. As described above, a person of ordinary skill in the art would find no rational reason to modify the LeMartret reference with the Zhou reference.

As another example, Applicant's claim 32 recites that the receiver comprises a time-hopping de-spreading module that applies a first de-spreading matrix to the UWB signal to de-interleave chips into blocks of frames, and a multi-user de-spreading module that applies a second de-spreading matrix to de-interleave the frames and produce blocks of estimate symbols.

The LeMartret reference discloses recovering symbols by converting the received signal into chips and applying a time-hopping de-spreading code matrix to the chips. The Zhou reference discloses recovering symbols by converting the received signal into chips and applying a user-specific de-spreading code matrix to the chips. However, neither reference describes recovering a stream of symbols from the received signal using a two-stage de-spreading unit having both a time-hopping de-spreading module and a multi-user de-spreading module. As described above, a person of ordinary skill in the art would find no rational reason to modify the LeMartret reference with the Zhou reference.

For at least these reasons, the Examiner has failed to establish a prima facie case for non-patentability of Applicant's claims 1-9, 14-16, 19-24 and 26-33 under 35 U.S.C. 103(a). Withdrawal of this rejection is requested.

CONCLUSION

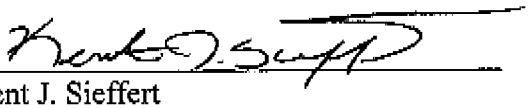
All claims in this application are in condition for allowance. Applicant respectfully requests reconsideration and prompt allowance of all pending claims. Please charge any

additional fees or credit any overpayment to deposit account number 50-1778. The Examiner is invited to telephone the below-signed attorney to discuss this application.

Date:

February 14, 2008

By:



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